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RESEARCH ARTICLE

DETERMINANTS OF MARKET PARTICIPATION DECISION AND LEVEL OF PARTICIPATION OF DAIRY FARMERS IN TIGRAY, ETHIOPIA: THE CASE OF RAYA

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ABSTRACT

The study was undertaken with the objective of assessing determinants of dairy market participation and level of participation in terms of litres of milk in Tigray, Ethiopia.240 households were selected using simple random sampling method. Data were collected using formal survey. The data collected were analysed using both descriptive and Heckman two-step selection econometric models. The binary probit model results revealed that Age of the Household head, child age under six years old, family size, distance to the nearest market centre, transportation access and total litres produced per-day played a significant role in dairy market participation. Heckman second-step selection estimation indicated that level of education of the household head, access to extension services, Total litres produced per day, land ownership and non dairy participation significantly affected level of dairy market participation in litre of milk sales. The researchers recommend that government with its extension workers and other development institutions and partners should give due emphasis on capacity building, which increases dairy households bargaining power by getting information related price, demand and supply, through practical based training. Besides, facilitate the opening of dairy market outlets near to them, which minimise transaction costs and spoilage of milk, and insist them to integrate modern cross breed cows.

INTRODUCTION

Increasing participation in agricultural markets is a crucial factor to lifting rural households out of poverty in Africa (Delgado 1998). Markets represent a channel for sectoral and macroeconomic policies that target to improve well-being of farm households. Inspiring participation of subsistence farmers into market will aid them to benefit from these economic opportunities and is significant to realize food security and poverty alleviation. Yet the economic literature on market participation, while growing in scope and degree, remains to be relatively thin (Bellemare and Barret 2006). Dairy marketing is a crucial constraint to dairy development in sub-Saharan Africa, where Ethiopia is not an exception. Marketing problems need be addressed if dairying is to secure its full potential to deliver food and motivate broad-based agricultural and economic growth and development. The rapidly growing urban population creates a rapidly expanding urban demand for milk and is the primary focus of dairy development efforts. However, most rural people do not live near large urban centres. In seeking to ensure that agricultural development plays its crucial role in overall economic development, the role of dairying in rural development should not be overlooked.

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There is scanty literature on factors affecting dairy products supply decision in Ethiopia. Number of dairy cows, education level of household head, visits by extension agents and distance from nearest market centers significantly affected milk market participation decision and level of supply. Distance from milk market centers exhibited negative relationship with milk market participation and level of supply. However, some failed to take the importance of dairy household‟s access to credit service, market information service, income source and demographic factors into consideration.

To, our knowledge there was no research to date on the study area regarding diary market participation and level of participation. Therefore the researchers were interested to find out this and contribute to the scanty literature or knowledge.

Objectives of the study

General objective

To assess the determinants of dairy market participation decision and extent (level) of participation of dairy households in Raya Azebo, Ethiopia

Specific objectives

- To examine whether there is a significant difference between local pure cows and cross breed cows in relation to milk production.
- Identify and analyze the determinants of diary market participation decision by households.

secondary data sources of the zone and wereda and guided visits to already proposed study Tabias were done.

Sampling Technique

Formal survey was conducted with dairy market actors such as dairy farmers and officers.

Hypothesis

Symbol, definition and hypothesized sign of explanatory variables: Definition	Symbol	Values	Type of variable	Hypothesized sign
Diary market participation	DMP	1=Yes, 0=No	Dummy	
Age of Household head	AGE	Number of years	Continuous	(-)
Sex of household head	SEX	(Male=1;Female=0)	Dummy	(+)
Education level of household head	EDU	Years of schooling	continuous	(+)
Family size of household	HSIZE	Man equivalent	Continuous	(-)
Presence of children under age six	CHILD	(1 if < 6 year and 0 otherwise)	Dummy	(-)
Distance from dairy market	DIST	Kilometer	Continuous	(-)
Access to extension service	EXT	1=Yes, 0=No	Dummy	(+)
Milk yield per day	YIELD	Litter	Continuous	(+)
Acess to milk market information (1=Yes, 0=No)	INFO	(1=Yes, 0=No)	Dummy	(+)
Milk price offered by market outlets	PRICE	birr per liter	Continuous	(+)
Cooperative membership	MEMB	1=member, 0=otherwise	Dummy	(+)
Land size holding	LAND	hectare	Continuous	(+)
Income from non-diary sources	INFDS	birr	continuous	(+)
Access to credit	ACCR	(1=Yes, 0=No)	Dummy	(+)

MATERIALS AND METHODS

Study area description

Raya Azebo is one of the woredas in the Tigray region of Ethiopia. located in the Debubawi zone at the eastern edge of the Ethiopian highlands, Raya Azebo is bordered on the south by Amhara region, on the southwest by Alamata, on the west by Ofla and Endamehoni, on the northwest by Alaje, on the north by Debub Misraqawi (southeastern) zone, and on the east by the Afar region. The administrative center of this woreda is Mehoni. Based on the 2007 national census conducted by the central statistical agency of Ethiopia (CSA, 2007), this woreda has a total population of 135,870. A total of 32,360 households were counted in this woreda, resulting in an average of 4.20 persons to a household, and 31,468 housing units.

Data Types and Sources

Both quantitative and qualitative data types were used in the study under investigation. In order to generate these data types, both secondary and primary data sources were used. Secondary sources include reports, journals, books, CSA and internet browsing, national policies, zonal and wereda reports, among others. Primary data sources include Raya Azebo Cattle Breeding and Multiplication Center, tabia extension agents and dairy farmers.

Methods of Data Collection

The major data collection methods employed were questionnaire, key informant interview and observation. A preliminary assessment was conducted to collect basic information about the woreda in order to select representative Tabias and kebeles. This information was generated through discussions and individual expert contact at woreda Agricultural and Rural Development Office. In addition, using

To conduct formal survey with dairy farmers, four *Tabias* (*Tsigia,Abo, Wargiba, Genetie)* and *Mohoni* town were selected on the basis of dairy production and milk sales potential. Within these *Tabias* and the town, 24 *kebeles* were selected based on their production and milk sales potential. Sample frame of the *kebeles* was updated and sample size was determined. Previous studied researches on dairy households took sample sizes of 61 households by Gizachew (2005) ,68 households Holloway *et al.* (2002), 180 households Woldemichael (2008) and 394 households by Berhanu Kuma *et al.* (2011). Therefore, we took a sample of households within the range of the minimum and maximum samples taken before and they found no sample size problems in their reports. Hence, out of the total 7,091 dairy farmers owning at least one dairy cow since the previous two years in the selected tabias, 240 representative dairy farmers were determined using proportionate sampling method. Households were selected using systematic random sampling method and we employed a purposive sampling method to select the extension agents of tabias and wereda animal food and breeding officers.

Table 1. Sample size by tabia

Selected tabia	No of households owning at least one cow	Proportionate sample size ($\frac{240}{7091} = 0.034$)
Abo	945	945*0.034 = 32
wargiba	1236	1236*0.034 = 42
tsigea	1795	1795*0.034 = 61
genete	1416	1416*0.034 = 48
mokoni	1699	1699*0.034 = 57
Total	7091	240

Methods of Data Analysis

Two types of data analysis, namely descriptive statistics and econometric models were used for analyzing the data collected from dairy farmers of the study area.

Descriptive statistics

The descriptive data analysis employed descriptive statistics such as percentage, mean comparison, standard deviations and statistical tests (t-test and chi-square tests).

Econometric analysis

The Methodological framework and selection of econometric model employed were depending on the objectives and hypotheses tested and verified. In order to identify determinants of dairy market participation decision and level of participation, Heckman two-stage selection model was used. In selectivity models, the decision to participate was seen as a sequential two-stage decision making process. In the first-stage, dairy farmers make a discrete decision whether or not to participate in dairy market. In the second-stage farmers make continuous decision on the level of participation in litres of milk sales.

In the first-stage, we used the binary probit model, which follows random utility model and Specified as Wooldridge (2002).

$Y^* = Z'\alpha + \varepsilon_1$
$Y = 1$ *if* $Y^* > 0$
$Y = 0$ *if* $Y^* \leq 0$

Where,

Y *= latent (unobservable) variable representing farmers' discrete decision whether to participate in dairy market or not.
Z' = vector of independent variables hypothesized to affect farmer's decision to participate in dairy market
α = vector of parameters to be estimated which measures the effects of explanatory variables on the farmer's decision to participate.
ε 1 = normally distributed error with mean (0) and standard deviation of δ1, and captures all unmeasured variables.
Y = dependent variable which takes on the value of 1 if the farmers particicipate in dairy market and 0 otherwise.

Since the probit parameter estimate does not show by how much a particular variable increases or decreases the likelihood of participation, marginal effects of the independent variables on the probability of a dairy farmer to participate were considered. For continuous independent variables, the marginal effect was calculated by multiplying the coefficient estimate by the standard probability density function by holding the other independent variables at their mean values. The marginal effect of dummy independent variables were analyzed by comparing the probabilities of that result when the dummy variables take their two different values while holding all other independent variables at their sample mean values (Wooldridge, 2002).

Finally, the log likelihood function which is maximized to obtain parameter estimates and corresponding marginal effects were used to estimate the parameters.

$$Ln\ L\left(\frac{\alpha}{\gamma}, Z\right) = \sum_{y=1} LN(\emptyset(Z'\alpha) + \sum_{y=0} \ln\left(1 - \emptyset(Z'\alpha\right)$$

Conditional on participation decisions, the variables determining level of participation was modelled using the second-stage Heckman selection model (Heckman, 1979). The Heckman selection equation was specified as follows:

$Zi^* = Wi'\alpha + \varepsilon_2$
$Z\,i = Z\,i^*$ *if* $Zi^* > 0$
$Zi = 0$ *if* $Zi^* \leq 0$ (3)

Where

Zi^* = latent variable representing the desired or optimal level of participation
which is observed if $Zi^* > 0$ and unobserved otherwise
Zi = observed level of participation
Wi = vector of covariates for unit i for selection equation which is a subset of Z'
α = vector of coefficients for selection equation
ε_2 = random disturbance for unit i for selection equation

RESULTS AND DISCUSSION

This section presents the results of descriptive and econometric analysis of the study. Descriptive analyses on the characteristics of the households and their participation in dairy markets are presented and discussed in this section. Results of the econometric estimation of dairy market participation and level of participation are also presented and discussed.

Socioeconomic characteristics of dairy market participants and non participants

Out of the 240 households, 27.5% were dairy market participants while the remaining (72.5%) did not participate in dairy market.

Table 2. Market participation

Market participation	Frequency	Percent
Non participants	174	72.50
Participants	66	27.50
Total	**240**	**100.00**

Table 2 shows that out of the total surveyed households majority of them (72.5%) were not participating at the time of the study. For this reason, the researchers can conclude that farmers may not have a necessary market information and high transaction cost to participate in the dairy market.

Even though insignificant mean age of non participant was higher than participant.

The t-statistics value shows that mean difference in educational level among dairy market non-participants and participants was statistically significant and negative. Hence, the researchers can conclude that the mean educational level of household head for dairy market participants was higher than non-participants.it reveals that there is a direct relationship between educational level of the household and dairy market participation.

Table 3. mean socioeconomic and demographic characteristics of dairy market participants and non-participants

variable	Mean value and str.err. of variables		t-value
	participant	Non-participant	
Age of Household head	43.57576(1.243362)	43.84483(0.9012208)	0.1629
level of education of Household head	3.621212(0.4218757)	1.821839(0.1881371)	-4.4900*
Family size	5.924242(0.2318574)	6 (0.1576352)	0.2584
No. of Children under six year of age	0.9545455(0.102263)	1.439306(0.0739248)	3.5811*
Distance to the nearest urban center	1.611667(0.3131701)	5.748678(0.3433908)	7.0066*
Land holding size of household	0.556452(0.0606159)	0.785256(0.0390316)	3.1447*
Total litres of milk produced per day	6.916667(0.5511784)	3.347701(0.1528975)	-8.5015*
No. of cross breed cows	0.8125(0.1333984)	0.090226(0.0271252)	-7.2052*
No.of pure local cows	1.106061(0.184642)	1.763006(0.0896745)	3.5601*

values in parenthesis are robust standard errors. ***, ** and *: statistically significant at 10%, 5% and 1% respectively

Table 4. Total litres produced per day by cow type

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
pure(local cows)	196	3.505102	.1488219	2.083507	3.211595	3.798609
cross breed cows	44	8	.7428304	4.92738	6.50194	9.49806
combined	240	4.329167	.2135775	3.308728	3.908432	4.749901
diff		-4.494898	.4701652		-5.421115	-3.568681
diff = mean(pure(loc) - mean(cross br)			t = -9.5603		Pr(T > t) = 0.0000	

Table 5. level of participation in number of litres of milk by access to extension service

Variable	Obs	Mean	Std. Err.	Std. Dev	[95% Conf. Interval]	
non recipients	91	.510989	.1212919	1.15705	.2700215	.7519565
Recipients	149	1.157718	.1758661	2.146719	.8101852	1.505251
combined	240	.9125	.120013	1.859233	.6760817	1.148918
diff		-.6467291	.2443063		-1.128008	-.1654502
diff = mean(no) - mean(yes)			t = -2.6472		Pr(T > t) = 0.0087	

The mean family size of participants is higher than non participants and positive even though the t-statistics value shows that it was statistically insignificant. The t-statistics value shows that mean difference in Number of children under six year of age among dairy market non-participants and participants was statistically significant and positive. Hence, the researchers can conclude that the mean Number of children under six year of age of household head for dairy market participants was lower than non-participants. This shows that there is an indirect relationship between Number of children under six year of age and dairy market participants.

The t-statistics value shows that mean difference in Distance to the nearest urban centre among dairy market non-participants and participants was statistically significant and positive. This reveals that there is an indirect relationship between Distance to the nearest urban centre and dairy market participants. Hence, the researchers can conclude that the mean Distance to the nearest urban centre of household head for dairy market participants was lower than non-participants. The t-statistics value shows that mean difference in Land holding size of household among dairy market non-participants and participants was statistically significant and positive. Hence, the researchers can conclude that the mean Land holding size of household head for dairy market participants was lower than non-participants. This reveals that there is an indirect relationship between Land holding size of household and dairy market participants. This indicates that market oriented dairy production doesn't necessarily require large hectare of land.

The t-statistics value shows that mean difference in Total litres of milk produced per day among dairy market non-participants and participants was statistically significant and negative. Hence, the researchers can conclude that the mean Total litres of milk produced per day of household head for dairy market participants were higher than non-participants. This reveals that there is a direct relationship between Total litres of milk produced per day and dairy market participants. This indicates

that high yield of milk production will result in surplus milk left out of consumption and motivates them to participate. The t-statistics value shows that mean difference in Number of cross breed cows ("yeferenj lam") among dairy market non-participants and participants was statistically significant and negative. Hence, the researchers can conclude that the mean Number of cross breed cows ("yeferenj lam") of household head for dairy market participants were higher than non-participants. This reveals that there is a direct relationship between Number of cross breed cows ("yeferenj lam") and dairy market participants. This indicates that high yield of milk production from the cross breed cows motivates the household head to participate and /or sell milk to the market. The t-statistics value shows that mean difference in Number of pure local cows ("ye habesha lam") among dairy market non-participants and participants was statistically significant and positive. Hence, the researchers can conclude that the mean Number of pure local cows ("ye habesha lam") of household head for dairy market participants were lower than non-participants. This reveals that there is an indirect relationship between Number of pure local cows ("ye habesha lam") and dairy market participants. This indicates that low yield of milk production from the pure local cows drives the household head not to participate and /or sell milk to the market.

The t-statistics value shows that mean difference in total litres of milk produced per day among pure local cows ("ye habesha lam) and cross breed cows (ye ferenj lam) was statistically significant and negative. Hence, the researchers can conclude that the mean litres of milk produced per day of pure local cows ("ye habesha lam") were lower than cross breed cows (ye ferenj lam). This reveals that there is an indirect relationship between pure local cows ("ye habesha lam") and total litres of milk produced per day. The t-statistics value shows that mean difference in litres of milk sold among extension service recipients and non-recipients was statistically significant and negative. Hence, the researchers can conclude that the mean litres of milk sold of extension service recipients were higher than non-recipients of extension services. This reveals that there is a direct relationship between extension service recipients' and litres of milk sold.

Econometric analysis

Factors affecting dairy market participation

Milk is produced for both sales and consumption in the milk shed. Various variables are assumed to determine dairy market participation and the level of dairy market participation by sampled dairy households. The study used the variance inflation factor to check multi-co linearity among continuous Variables. According to the test results there was an average vif (tolerance) of 1.76. Which is below 10 and tolerable (multicollinearity was not a serious problem) (appendix I). As a result, all the variables in the list were considered for the model analysis.

Regression output of the Heckman two stage analyses

The econometric analysis for the Heckman two-step estimation procedures was performed using Stata version 12. The Heckman two-step procedure was employed in order to control the selectivity bias and endogenity problem and obtain consistent and unbiased parameter estimates. The model in the first stage predicts the probability of participating in the dairy market by each household; in the second stage, it analyses the determinants of level of dairy market participation. Maddala (1983) suggested using selection variable that is assumed to affect the participation decision largely, but not level of participation in the selection equation, which enables the inverse Millis' ratio to predict correctly. Accordingly, this study used family size as selection variables in probit model/participation equation which was found to affect the milk market participation decision by dairy household, but has no significant impact on level of dairy market participation in order to predict lamda(inverse Mill's ratio) correctly.

The binary probit equation/dairy market participation Equation

The model output reports result of estimation of variables that are expected to determine dairy market participation of households. Age of the Household head, child age under six, family size, distance to the nearest market centre, transportation access and total litres produced per-day were found to determine the probability of dairy market participation significantly.

Table 6. First stage probit estimation results of factors affecting probability of dairy market participation decision model

variable	coefficient	Marginal effect $\frac{\partial P(y=1/x)}{\partial x}$	p>/z/
hhage	-0.0343165(.0133637)	-0.0087166(.00237)	0.010*
HHeduc	0.0646219 (.0436855)	0.0129419 (.00965)	0.139
hhsex	-0.4783726 (.3553832)	-0.1342745(.10716)	0.178
Family size	0.1802515 (.0799697)	0.0396799 (.01841)	0.024**
childage6	-0.4047115(.16939)	-0.09272 (.04032)	0.017 **
distance	-0.1723441(.0445689)	-0.0405355 (.00885)	0.000 *
Transportation access	1.02616 (.4066587)	0.1926685 (.06304)	0.012 **
Extention service	0.0633353 (.2855121)	0.0126406(.06262)	0.824
totallitersproduceperday	0.218949 (.0462757)	0.0489038(.01279)	0.000*
marketinformation	0.5982543 (.3696374)	0.1151343(.06516)	0.106
landown	-0.2174838 (.4044202)	-0.0574778(.1049)	0.591
landsize	-0.0635704 (.3618926)	-0.0066813(.08017)	0.861
Non diarypartn	-0.7184746 (.5301376)	-0.2534845(.16596)	0.175
credit	0.2643397 (.3283244)	0.0491276 (.06181)	0.421
constant	-0.4728265(.8764001)	-	0.590

No.observations =240, Log likelihood = -68.137644*, LR chi2 (14) = 146.05, Pseudo R2 = 0.5173.values in parenthesis are robust standard errors. ** And *: statistically significant at 5% and 1% respectively.

Household head's age (hhage)

The model result shows that as expected age of the household head had a negative and significant impact on market participation decision of the sampled dairy households. The negative and significant relationship between the two variables indicates that older dairy household head could have less milking cows decreasing the probability of the household dairy market participation decision. The marginal effect also confirms that when the household age increases by one year, the probability of participating in the dairy market decreases by 0.87%.

Transportation access

Transportation access has positive effect on probability of dairy household dairy market participation decision and is significant at less than 5% probability level. The positive and significant relationship indicates that access to transportation improves the dairy household head's capacity to reach the market easily and reduces the transaction cost in finding the right buyer in the centre and market related information, which in turn improves bargaining position. The marginal indicates that an addition of one-year formal schooling leads the probability of dairy household dairy market participation to increase by about 19.26%.

Child age under six

The variable is statistically significant at less than 5% significance level. As expected, the variable has a negative effect on probability of dairy household dairy market entry decision. The negative and significant relationship implies to situations where the household has more children below six (working) age, who thus do not contribute to farm labour but significantly increase household consumption. The marginal effect of the variable also shows that for every one additional child under age six the probability of dairy market participation decision of the household decreases by 9.2%

Family size

The variable is statistically significant at less than 5% significance level. To the contrary of our expectation, the variable has a positive effect on probability of dairy household dairy market entry decision. The positive and significant relationship indicates that as dairying is labour intensive activity, larger family size provides higher labour to undertake dairy production and management activities easily which in turn increases daily marketable milk volume leading to increased capacity of dairy household dairy market participation. The marginal effect of the variable also emphasizes that for every one person increase in a family increases the probability of dairy market participation decision of the household by 3.9%.

Total litres produced per-day

Total litres produced (milk yield) per day is positively related and statistically significant with the dairy market participation decision. The marginal effect of the variable reveals that an increase in milk yield per day by a litre results in 4.89% increase in the dairy market Participation (in litre of milk) decision because high milk yield could result in high surplus of milk left from consumption which can increase the motivation of households to sell the extra and even more milk in the dairy market.

Distance

As expected distance to the nearest market centre has negative effect on dairy market participation and found to be statistically significant at less than 1% significance level. The negative relationship indicates that the farther is a household from the dairy market, the more difficult and costly it would be to get involved in the dairy market. The marginal effect also confirms that a one-kilometre increase in dairy market distance from the dairy farm owner reduces the probability of participation in dairy market by 4.05%.

Estimation results of second stage Heck man selection model

The results of second stage Heckman selection estimation for level of household participation in dairy market in terms of litres of milk are presented in Table 7. The overall joint goodness of fit for second stage Heckman selection model parameter estimates is assessed based on Wald chi-square test. The model chi-square test applying appropriate degree of freedom indicates that the overall goodness of fit for second stage Heckman selection model is statistically significant at a probability of less than 1%. It shows that jointly independent variables included in Heckman selection model explained level of participation in litre of milk. In the Heckman second stage selection model, five explanatory variables: level of education of the household head, access to extension services, Total litres produced per day, land ownership and non dairy participation had significantly affected level of dairy market participation.

Table 7. Results of second stage Heckman selection estimation for level of dairy market participation

variable	coefficient	Standard error	p>/z/
constant	3.373649	2.450403	0.169
Age of Household head	-0.043368	0.0278145	0.119
Level of education of household head	0.1558376	0.0624866	0.013**
Sex of household head	-0.5318716	0.5222289	0.308
Family size	0.0344171	0.1257567	0.784
Child under six year age	0.1516348	0.3101365	0.625
Distance to nearest centre	-0.1037498	0.1512611	0.493
Transportation access to market centre	0.1832368	1.596547	0.909
Access to extension service	1.109367	0.4018607	0.006*
Total litres produced per day	0.394548	0.061623	0.000*
Access to market information	-0.0006895	0.6746551	0.999
Price	-0.0313234	0.1167324	0.788
Land ownership	1.175234	0.6384232	0.066***
Land size	-0.8277206	0.6317112	0.190
Non dairy participation	-2.259585	1.040171	0.030**
Credit	-0.7188484	0.536093	0.180
Lamda	0.7717859	0.9053375	0.394

No. of observations =240, censored observations=66, uncensored observations=174, wald chi^2 (15) =81.82*, Rho=0.54885, sigma=1.4061863 . ***, ** And *: statistically significant at 10%, 5% and 1% respectively.

Household level of education

Education level of the household head has positive effect on Level of market participation in litres milk sale and it is statistically significant at less than 5% probability level. The positive and significant relationship indicates that education improves the dairy household capacity to process production related and market related information, which in turn improves bargaining position. The model output confirms that one formal year education leads the dairy household to increase

level of participation in litres of milk sale volume by 0.15 litres.

Total litres produced per day

Milk yield per day is positively related and statistically significant with the level of participation. This indicates that ceteris paribus, an increase in milk yield per day by a litre results in 39.45% increase in the level of Participation(in litre of milk) because high milk yield would result in high surplus of milk left from consumption which can increase the involvement of farmers in dairy market .

Access to Extension service

The model result shows that extension services given by the respective office to the household head had a positive and significant effect on level of dairy market participation of the sampled dairy households. The positive and significant relationship between the two variables indicates that an additional service and training given by the respective officers could increase the household head's capacity to produce and manage the diary product and access necessary information on market, production and management of the dairy product thereby increasing the probability of the household level of dairy market participation decision. The coefficient also confirms that when the household access to extension service increases by one unit, the probability of household head's level of dairy market participation decision increases by 110.93%.

Land ownership

Household head's land ownership has positive effect on level of dairy market participation and found to be significant at 10% probability level. The positive relation between the variables indicates that any additional hectare of land creates a capacity to produce food to the dairy cows and space for rearing which can contribute to increase milk production per household per day and then contribute to increase level of dairy market participation decision. The coefficient also confirms that when the household land owning increases by one hectare, the probability of household head's level of dairy market participation decision increases by 117.52%.

Non dairy participation

Household head's involvement in non-dairy farm has negative effect on level of dairy market participation and found to be significant at 5% probability level. The Negative relation between the variables indicates that any additional financial income hinders the dairy household to reduce the time and effort to be allocated to dairy farming which can contribute to decrease milk production per household per day and then contribute to decrease level of dairy market participation decision. The coefficient also confirms that when the household participation in non dairy farm increases by one unit, the probability of household head's level of dairy market participation decision decreases by 225.95%.

Lamda

According to the model output, the Lambda (Inverse Mills Ratio) or selectivity bias correction factor has positive, but statistically insignificant impact on dairy household marketable milk. This result suggests that there appears to be no unobserved factors that might affect both likelihood (probability) of dairy household market participation and thereby affecting the level of participation. However, the positive sign of the inverse mill's ratio shows that there are unobserved factors that are positively affecting both participation decision and level of participation.

Summary, conclusion and policy implications

Summery and Conclusion

The study was undertaken with the objective of dairy market participation in raya azebo area (woreda), Northern Ethiopia. Market participation decision and level of participation in litres of milk sale are found to be important elements in the study of dairy market. The Heckman two-stage analysis was used in order to capture the selectivity bias and get the impact on market participation decision and level of participation in litre of milk sale per household. Participation in dairy market is a dichotomous dependent variable, thus in the first stage of the Heckman two stage procedures, and the maximum likelihood estimation procedure, binary probit model was used. The maximum likelihood probit model analysis revealed that age of the household head, family size, children under six years age, transportation access, distance from the nearest milk market centre and total litres of milk produced per day were found to bring significant effect on probability of the households dairy market participation. However, the selection equation procedure identified education level of the household, total litres produced per day, access to extension service, land ownership and non dairy farm participation as an important factors affecting level of participation in litres of milk sales. The selection equation result depicts that about 81.82% of the variation in level of participation in litres of milk sale is explained by the independent variables used in the model.

Total litres produced per day by the household (milk yield) has positive and significant effect for both dairy market participation decision and level of participation. Distance from milk market as expected has negative and significant effect on dairy market entry decision. Each one-kilometer increase in distance from dairy market centre leads the dairy household market entry decision to decrease by about 0.17 probability level. Coming to the level of education of the household, education has significant effect on level of participation; however, education has important but insignificant effect on dairy market participation decision. Transportation access has significant effect on households' dairy market participation decision; however, transportation access has positive but insignificant effect on level of participation. Family size and children under age six have significant effect on households' dairy market participation decision; however, they have insignificant effect on level of participation.

Policy Implications

On the basis of the results of this study, the following policy implications are suggested in order to be considered in the future dairy sector related intervention strategies which are

intended at the promotion of dairy production and marketing in the study area in particular and in the country in general. The result of the first step of the Heckman two stage procedures (Probit) model analysis has shown that policy relevant variables having greatest effect on milk market participation decision were Age of the Household head, child age under six, family size, distance to the nearest market centre, transportation access and total litres produced per-day. Moreover, the second step of the Heckman two stage procedure (the selection equation) model analysis has shown that level of education of the household head, access to extension services, Total litres produced per day, land ownership and non dairy participation were policy relevant variables having greatest effect on level of participation in litres of milk sale in the study areas during the survey period.

As it was seen from the model analysis, total litres produced per day (milk yield) has positive and significant effect on both dairy market participation decision and level of dairy market participation in litres of milk sales, government and other existing and potential dairy sector development partners of the study area are required to give due attention in enhancing households capacity and management which in turn can help them increase their productivity and efficiency of dairy products the study areas in particular and of the country in general. As there is a significant difference in milk production between pure local cows and crossbreed cows, government and partners should give an awareness creation and promote the integration, if not at all replacement, of cross breed cows for they are providing greater amount of litres of milk per cow.

Access to extension service have been identified as the most important policy variable positively and significantly influencing the level of dairy market participation that can be employed as policy instrument in enhancing households' level of dairy market participation in litres of milk sales. This indicates that owning and milking a cow is not enough for the household but if it is supported and capacitated by the extension agents the household will more than 100% increase their level of market participation. Therefore, the government and other development agents and institutions should work together to fill the gaps of skill, attitude and new technologies to capacitate the households involve in the dairy market intensively which in turn can help them fight against poverty and contribute to their family and country development. Besides, it is required to enhance cooperation between dairy extension service providers and dairy households. This will enable the acceptance of improved dairy technologies which in turn will improve scale of milk production and contribute to increased marketable milk.

The probit model analysis also shown that Distance from milk market as expected has negative and significant effect on dairy market entry decision. Each one-kilometer increase in distance from dairy market centre leads the dairy household market entry decision to decrease by about 0.17 probability level. This negative valued relation of the variable also indicates that the closer the market centre, the lesser would be the transportation charges, reduced loss due to spoilage, and reduced other marketing costs, better access to market information and facilities of the dairy household.

Thus, the government should consider better means of coping with access problems to dairy market through increasing dairy market out lets and constructing new, and maintaining existing infrastructure facilities so as to reduce transaction cost related to distance from dairy market centres. Besides, the researchers insist that there is a great requirement to invest in road network to effectively link the households to market.

The selection equation of the Heckman two step procedure model analysis results has shown that household's level dairy market participation in litres of milk sales was positively and significantly affected by education level of the dairy household head. This result proves that education improves willingness to produce more and get updated with the price, demand and supply information which in turn enhances their readiness of the dairy household to accept new idea and innovations. Therefore, government with its extension agents and other dairy sector development partners should give due emphasis on capacity building of the dairy households through short and intermediate practical based training. Further, the selection equation of the Heckman two step procedure model analysis revealed that non-dairy farm participation of dairy household was found to affect the level of dairy market participation negatively. The netigavely related value of the variable suggests that as households generate income out of the sector they would give less attention to dairy sector. Therefore government and other partners should clearly tell the households on the benefit and method of dairy sector production and marketing that can motivate them divert their belief, work on it and allocate their resources.

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